

New insights in the development of pressure ulcers

Citation for published version (APA):

de Wert, L. (2019). *New insights in the development of pressure ulcers*. [Doctoral Thesis, Maastricht University]. Maastricht University. <https://doi.org/10.26481/dis.20190222lw>

Document status and date:

Published: 01/01/2019

DOI:

[10.26481/dis.20190222lw](https://doi.org/10.26481/dis.20190222lw)

Document Version:

Publisher's PDF, also known as Version of record

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

www.umlib.nl/taverne-license

Take down policy

If you believe that this document breaches copyright please contact us at:

repository@maastrichtuniversity.nl

providing details and we will investigate your claim.

Valorisation addendum

Valorisation addendum

Social and economic relevance

Pressure ulcers are a major problem and has a negative influence on health related quality of life. Prevalence rates are up to 9.6% in acute care settings and 6.1% in chronic care settings in the Netherlands. In addition, prevalence numbers of pressure ulcers are regarded as an important indicator of quality of care, because most pressure ulcers are considered to be avoidable. Although, not all pressure ulcers are actually avoidable, the occurrence of a pressure ulcer is often blamed on the lack of preventive measures carried out by healthcare workers.¹ Therefore, prevention of pressure ulcers remain a major burden for hospitals and health care organizations.

The financial impact is high, the United States (US) Agency for Healthcare Research and Quality estimate the total costs in the US between \$9.1 billion and \$11.6 billion annually, with individual treatment cost ranges between \$20.900 to \$151.700 per pressure ulcer. Not only are pressure ulcers associated with an increase in healthcare costs, they also have a negative impact on social and psychological aspects of quality of life, because they are associated with severe pain, and discomfort in patients. Subsequently, they are also associated with longer hospital stay, co-morbidities and mortality.² Research aimed at the prevention of pressure ulcers will further improve quality of life, morbidity and mortality in patients at risk for pressure ulcers.

One of the aims of this thesis was to improve quality of care, quality of life and financial outcomes. Therefore, we carried out a randomized controlled trial in high risk patents in the Maastricht University Medical Centre (MUMC) and investigated the effect of a multi-layered foam dressings in the prevention of sacral pressure ulcers. To address both quality of life and financial outcomes, patient related experiences, adverse device effects and economic evaluations were also reported.

Subsequently, we tried to regain more insight in the development of pressure ulcers and used these insights to test innovative solutions to prevent pressure ulcers by developing a new model and test this in healthy volunteers.

Target population

The results of this thesis are relevant for other researchers who are focussing on the pathophysiology and biomechanics of pressure ulcers. It offers more information about potential biomarkers such as the cutaneous microbiome in order to predict pressure ulcer risk in patients. The newly developed shear model can be used by other researchers to further investigate the effect of shear force on skin viability in patients. Further, it is also useful for healthcare companies whose profession it is to develop new materials, or optimize dressing design to prevent pressure ulcers in patients.

At last, the result of this thesis could be helpful for care providers who are implementing new pressure ulcer preventive strategies.

Innovation and future

This thesis presents new and innovative techniques to study the development and prevention of pressure ulcers. First, a new model was designed and validated which enables us to apply shear force on skin in humans and measure its effects by using IL-1 α , lactate and reactive hyperaemic skin responses. It is the first to describe that the reactive hyperaemic skin response and IL-1 α is increased when shear force is added to pressure.

The prevention of pressure ulcers by focussing on the effect of shear force on skin viability is innovative, because most preventive interventions are focused on pressure redistribution. Developing and testing shear reducing materials is a challenge for healthcare companies, due to the lack of a validated method to apply shear force and the lack of robust measurement techniques. With the help of our newly developed model, we were the first to prove the protective effect of three commercially available dressings against shear forces *in vivo*. Further, we were able to prove that multi-layered dressings performed better than the single-layered foam dressing. The optimal dressing design to prevent pressure ulcers remains unknown. Therefore, future laboratory studies are necessary to determine the ideal properties of preventive dressings. In addition, their clinical relevance and financial efficiency should be tested in randomized controlled trials in several groups of patients with a high incidence of pressure ulcers.

Another innovative aspect is the relation between pressure ulcers and the cutaneous microbiome. This thesis proved that the cutaneous microbiome of the unaffected skin is different compared with those with pressure ulcers. This offers new possibilities in patients at risk for pressure ulcers. First, the cutaneous microbiome could possibly be used as a biomarker to predict pressure ulcer risk in patients. Second, modulating the human microbiome has shown potential in prevention and treatment of several diseases.^{3,4} However, these potential possibilities should be further investigated in future prospective cohort studies before it could be implemented in daily practice.

References

1. Black JM, et al. Pressure ulcers: avoidable or unavoidable? Results of the National Pressure Ulcer Advisory Panel Consensus Conference. *Ostomy Wound Manage.* 2011;57(2):24-37.
2. Bates-Jensen BM. Quality indicators for prevention and management of pressure ulcers in vulnerable elders. *Ann Intern Med.* 2001;135(8 Pt 2):744-751.
3. Turnbaugh PJ, et al. The human microbiome project. *Nature.* 2007;449(7164):804-810.
4. Grice EA, Segre JA. The skin microbiome. *Nat Rev Microbiol.* 2011;9(4):244-253.